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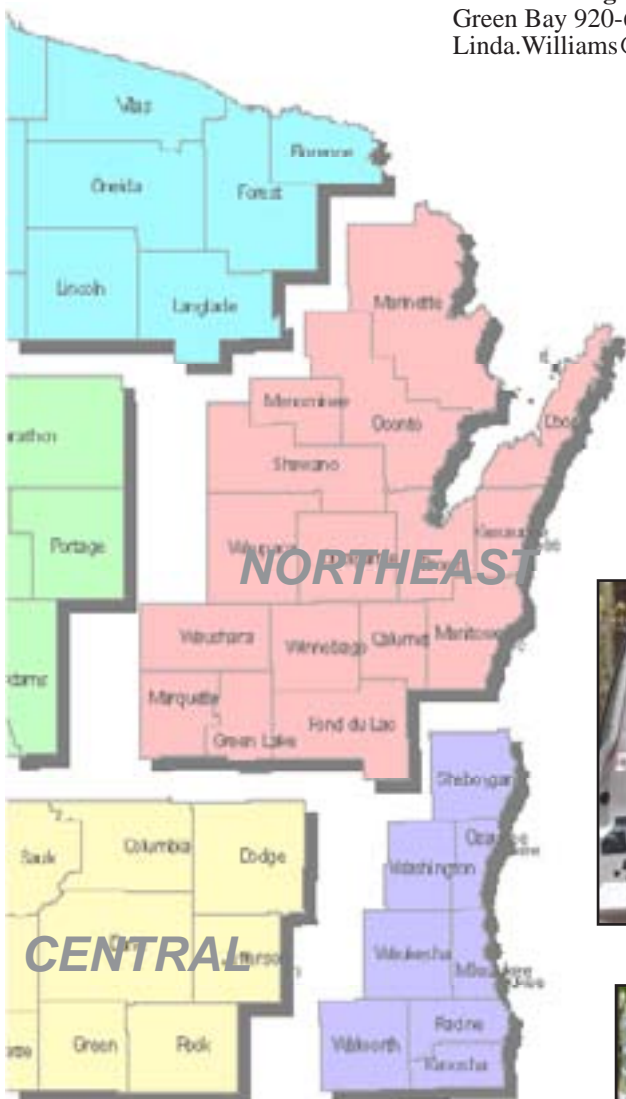
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Alerts

Emerald Ash Borer (EAB)



Adult emerald ash borer

Even though the Emerald Ash Borer (*Agrilus planipennis*) has not been found in Wisconsin, new infestations continue to be detected in Indiana, Ohio and Michigan. DNR, the Department of Agriculture, Trade and Consumer Protection and the University of Wisconsin Extension, have all been active in surveying for EAB. All of Wisconsin's state parks and state forests with campgrounds (and ash) have been surveyed. Approximately 100 private campgrounds in northeast and southeast Wisconsin have also been surveyed. "Detection trees" or ash trees that are girdled to draw in EAB, were established and examined at 12 sites throughout our state forests, along the Lower Wisconsin Riverway, and throughout the Nicolet and Chequamegon National Forests.

In 2006, visual surveys will continue on private campgrounds in south-central and central Wisconsin and detection trees will be established on 25 state properties throughout the state. These sites will be chosen based on the frequency of ash and number of visitors that originate from areas that have EAB.

New Publications Available:

Several new publications on the Emerald Ash Borer will be arriving at the DNR publications warehouse **in 2006**. DNR employees can order these through the OTIC system or by contacting Wayne Behrens (715-453-1254). If you are not a DNR employee, please contact your regional forest health specialist for assistance with ordering. <http://dnr.wi.gov/org/land/Forestry/FH/Staff/index.htm>. Municipal and other urban forestry-related individuals should contact their regional urban forestry specialist. <http://dnr.wi.gov/org/land/Forestry/UF/staff/>

- 1) ***The Green Menace (folding brochure)***. (PUB-FR-348-2006) This brochure provides biology, symptoms and signs (with photos) and a several website addresses. A great general piece.
- 2) ***The Green Menace (DVD)*** (PUB-FR-352-2006) This DVD (approximately 20 minutes) is an excellent overview of the history, biology and impact of the Emerald Ash Borer.
- 3) ***Credit-card sized EAB ID cards*** (PUB-FR-353-2006) This plastic credit-card sized piece has actual-size photos of an EAB adult, larva and exit hole along with a website address.
- 4) ***USDA FS EAB pest alert*** (PUB-FR-354-2006) This one-page (8.5" X 11") pest alert has the basic biology and history of EAB along with several photos of symptoms and signs.
- 5) ***Folding EAB ID card*** with 1-800 reporting number on it. (Pub-FR-290-2006) This 4" X 3" card opens up to reveal photos of symptoms and signs of EAB. It also has the WI 1-800 EAB reporting number on it, along with DNR's invasive species web site address.
- 6) ***Frequently Asked Questions about the Emerald Ash Borer and Emergency Rule (geared for campers)***. (Pub - FR-344a 2006) A one-page 8.5" X 11", with questions and answers about the Emerald Ash Borer. Has some specifics related to the new Emergency Rule related to firewood.
- 7) ***Frequently Asked Questions about the Emerald Ash Borer (geared for landowners)***. (Pub - FR-344b 2006) A one-page 8.5" X 11", with questions and answers about the Emerald Ash Borer. Has some specifics related to homeowner and landowner issues.

What's the Latest on Regulating Firewood?

An interagency team has been working on developing regulations and procedures for limiting the movement of firewood into and around the state. Infested ash firewood is the primary way EAB moves long distances.

Our objectives:

The restrictions that the Natural Resources Board has decided to place on the movement of firewood into state properties is intended to reduce the spread of forest pests and diseases. For many of these pests, firewood is the chief form of transportation over long distances. The most recent pest, Emerald Ash Borer (EAB), could potentially destroy all of the 700+ million ash trees in Wisconsin. The negative impact on Wisconsin's aesthetics, municipal/state budgets, and the timber industry could be staggering. These actions may not stop EAB, but it may delay its spread until an effective control is developed or discovered. The first year, 2006, we are concentrating on educating the public as we take every realistic measure to slow the spread of these pests. The Department of Agriculture, Trade, and Consumer Protection is working with us to address the commercial shippers of firewood. This multi-agency approach is our best strategy.

An Emergency Administrative Rule will be pursued in 2006:

NR 45.04(1)(g) The rule states, "On department lands, no person may possess firewood that originates from outside the borders of the state of Wisconsin. Firewood includes all wood, processed or unprocessed, meant for use in a campfire. The department may seize and dispose of firewood possessed in violation of this paragraph."

The Permanent Administrative Rule will also be pursued in 2006 for implementation in 2007:

The process for creating a permanent rule addressing this issue will be initiated in 2006 and probably will result in a change in the laws for 2007. Public hearings and other means of public input will be a part of the process during the summer of 2006. The rules will possibly be stricter in 2007. For more information, you may call the toll-free number (877.303.9663) or check this website: <http://dnr.wi.gov/invasives/firewood/>

Are there any Silvicultural Guidelines that address EAB?

There is a draft of silvicultural guidelines that are being evaluated by the DNR silviculture committee. A finished product is expected to be available December, 2006.

Common Pine Shoot Beetle

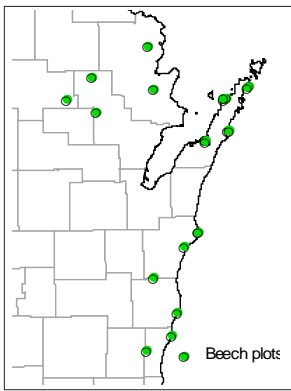
Effective February 1, 2006, the entire state of Wisconsin was quarantined for Pine Shoot Beetle (*Tomicus piniperda*).



This decision was based on data analysis and lengthy discussions regarding the low risk of impact this insect is expected to pose to the health of Wisconsin's pine resource. The decision, jointly made by the WI Department of Agriculture, Trade and Consumer Protection and USDA Animal Plant Health Inspection Service, eliminates restrictions on the movement of pine within the state and out of the state to areas that are also quarantined.

Beech Bark Disease

During the summer of 2005, visual surveys were conducted to detect beech bark disease caused by the beech scale



extensive beech mortality, was first detected in upper and lower Michigan in 2000, and has spread dramatically in Michigan since.

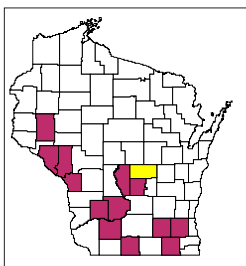
Survey sites (see map) were scattered across the distribution of beech, and were selected on the basis of local abundance and likelihood of accidental introduction on firewood. Most survey sites were in parks and campgrounds. At each site, a minimum of 20 trees were examined for the presence of the scale and disease. Beech scale and beech bark disease were **not** detected.

Foresters on the Menominee Indian Reservation have also been surveying for the disease and scale on the Menominee Reservation but, to date, have not found either.

Jack Pine Budworm

The jack pine budworm (*Choristoneura pinus*) population in northwest Wisconsin peaked, causing defoliation of jack pine on 222,500 acres in Polk, Burnett, Sawyer, Washburn, Douglas and Bayfield counties. In west-central Wisconsin, the population continued to build and may peak in 2006. Affected counties include Adams, Eau Claire, Jackson, Juneau, Marathon and Wood. A new phenomenon has been observed in Adams, Eau Claire, Juneau and Wood counties; jack pine budworm is feeding on red pine. Both young (20-30 year-old) and older stands are serving as feeding sites. It is unknown why this insect has crossed over to red pine. Past observations have noted very limited feeding on red pine. Red and jack pine that have been defoliated for 2 or more years are beginning to incur top mortality or total tree mortality.

Annosum Root Rot



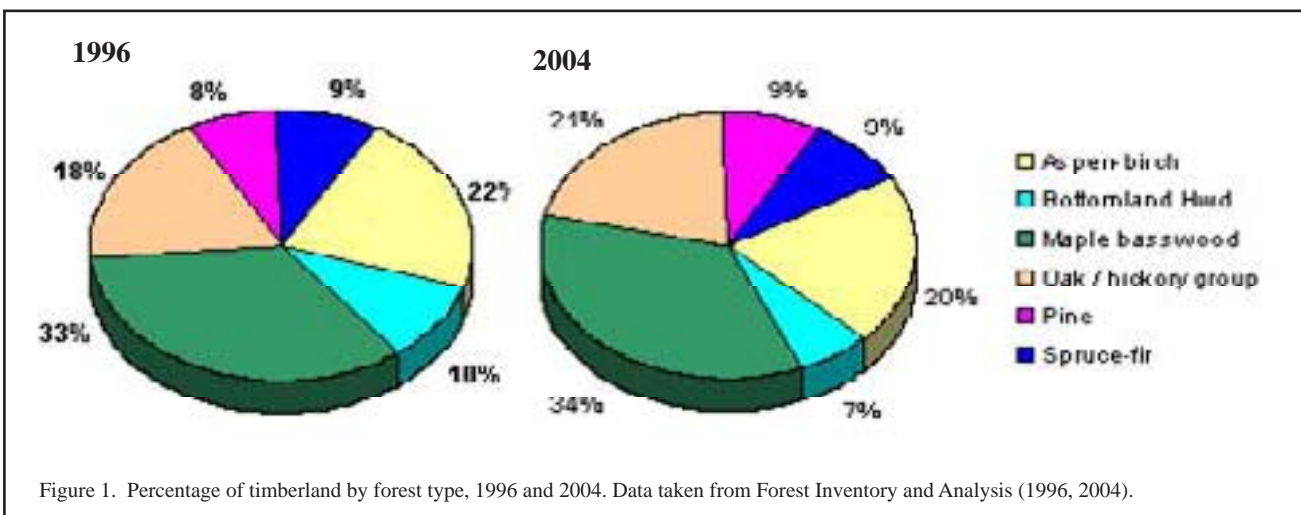
In 2005, Annosum root rot was found in a red pine stand in Waushara County (in yellow on the map). This brings the total number of counties with this disease to fourteen (Adams, Buffalo, Dunn, Green, Iowa, Jefferson, LaCrosse, Marquette, Richland, Sauk, Trempealeau, Walworth, Waukesha, and Waushara counties). Annosum root rot is caused by the fungus, *Heterobasidion annosum*. The fungus causes a decay of the roots and butt and often kills infected trees. In Wisconsin, Annosum root rot has been found primarily on red pine, and occasionally in white pine. The primary mode of infection is through freshly cut stumps. Spores land on the stump, grow through the root system, and infect adjacent healthy trees. Fruit bodies may be found

at the root collar of dead/dying trees and stumps of infected trees. A publication outlining the symptoms/signs and management recommendations can be obtained at:

<http://www.dnr.state.wi.us/org/land/forestry/fh/fhissues/annosum.htm>

Proportion of Forest Land and Timberland

—The area of forestland in Wisconsin has been steadily increasing in recent decades and currently stands at 15.7 million acres, representing 46% of the total land area. This is an increase of almost 1 million acres since 1983. The state now has the most forest land it has ever had at any time since the first forest inventory in 1936. Wisconsin's



forests are predominately hardwoods, with 84% of the total timberland area classified as hardwood forest types. The primary hardwood forest type in the state has changed from the 1930's when aspen-birch comprised 40% of timberland (Figure 1). As our forests have aged, these types which dominated on cut-over land have been replaced by later successional species such as maple-basswood and oak-hickory which account for 52% of timberland acreage. (Timberland is defined as forest land that is producing, or is capable of producing, more than 20 cubic feet per acre per year of industrial wood crops under natural conditions, that is not withdrawn from timber utilization, and that is not associated with urban or rural development.)

Ownership of Wisconsin's Timberland

—Individual private landowners are the largest group of timberland owners in Wisconsin, owning 57% of all timberland in 1996 (Figure 2). Counties and municipalities are the largest group of public owners, holding 15% of the total area of timberland in Wisconsin. The public owns a total of 30% of all timberland. The percentages of ownership have remained relatively constant since the forest inventory in 1956.

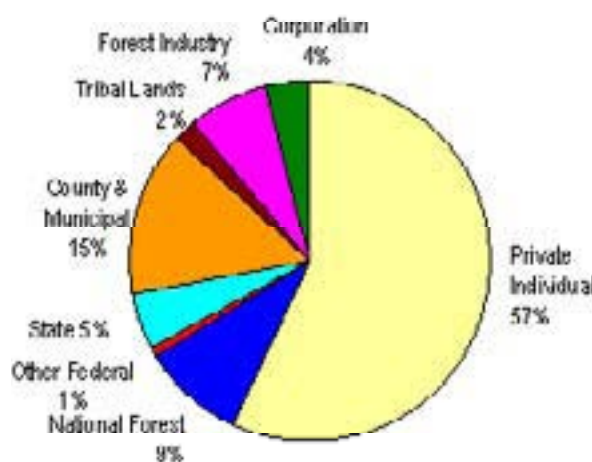


Figure 2. Forest ownership. (1996 FIA data)

Growing-stock Volume of Wisconsin's Timberland

—Growing-stock volume on timberland in Wisconsin increased from 15.5 billion cubic feet in 1996 to 19.7 billion cubic feet in 2004, reflecting an increase in both area and stocking between inventories. In both 1983 and 1996, hardwoods accounted for $\frac{3}{4}$ of all growing-stock volume. Acreage in seedling-sapling stands had been decreasing and acreage in sawtimber stands had been increasing since 1938 reflecting the natural aging of forests since the

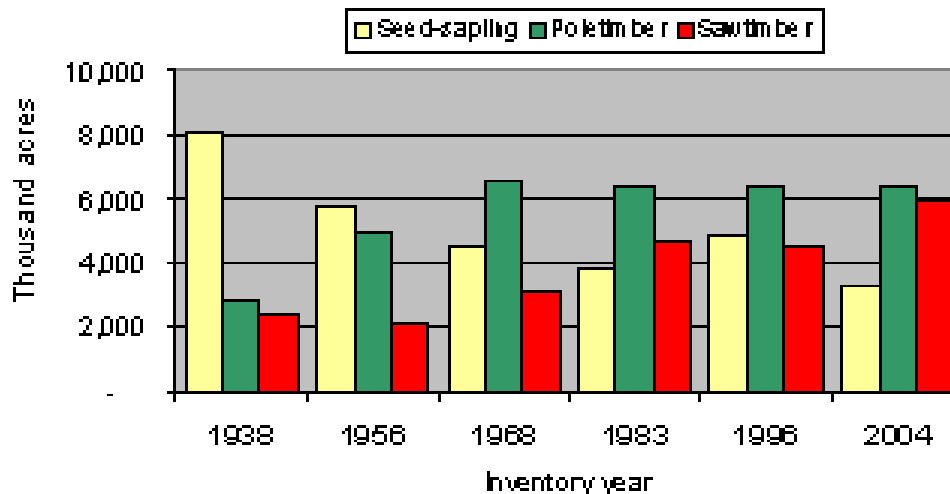


Figure 3. Acreage by size class on timberland in Wisconsin, 1938-2004. Data taken from USDA Forest Inventory and Analysis.

Most Common Species Groups of Wisconsin's Timberland

Although aspen accounted for the largest species group in 1996, white and red pine had the highest growing stock volume in 2004. Other species which have gained between the 2 inventories are red maple, pin oak, and ash spp. while volumes of aspen, red oak and jack pine have declined.

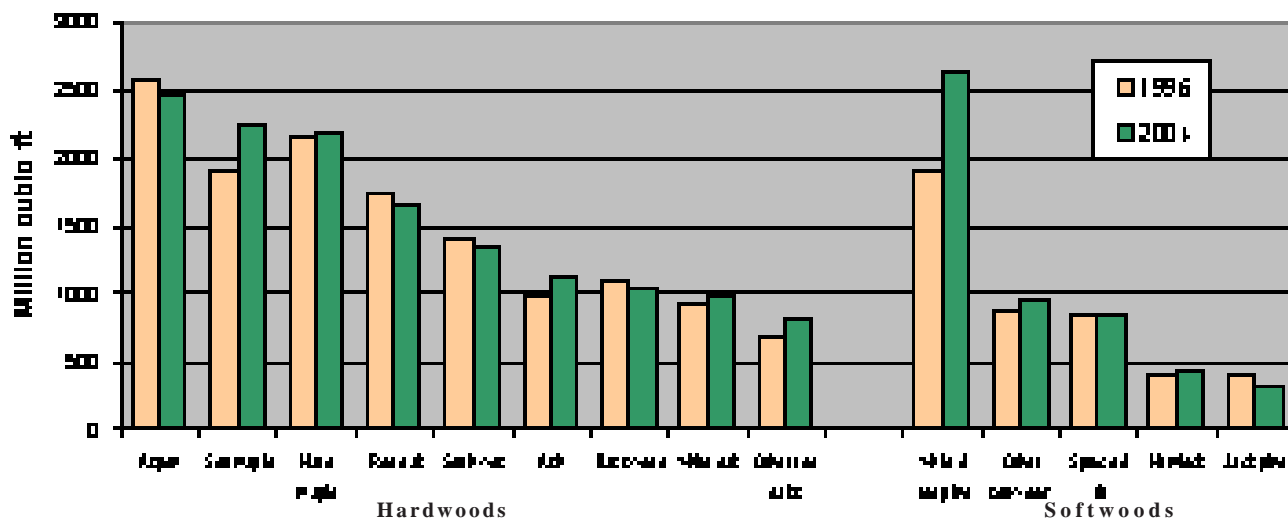


Figure 4. Most common hardwood and conifer species (in million cubic feet of growing stock volume) on timberland in Wisconsin in 1996 and 2004 (taken from Forest Inventory and Analysis data). Soft hardwoods include elm spp., boxelder, birch spp., and hackberry. Other softwoods include red and white cedar and tamarack.

Major Issues

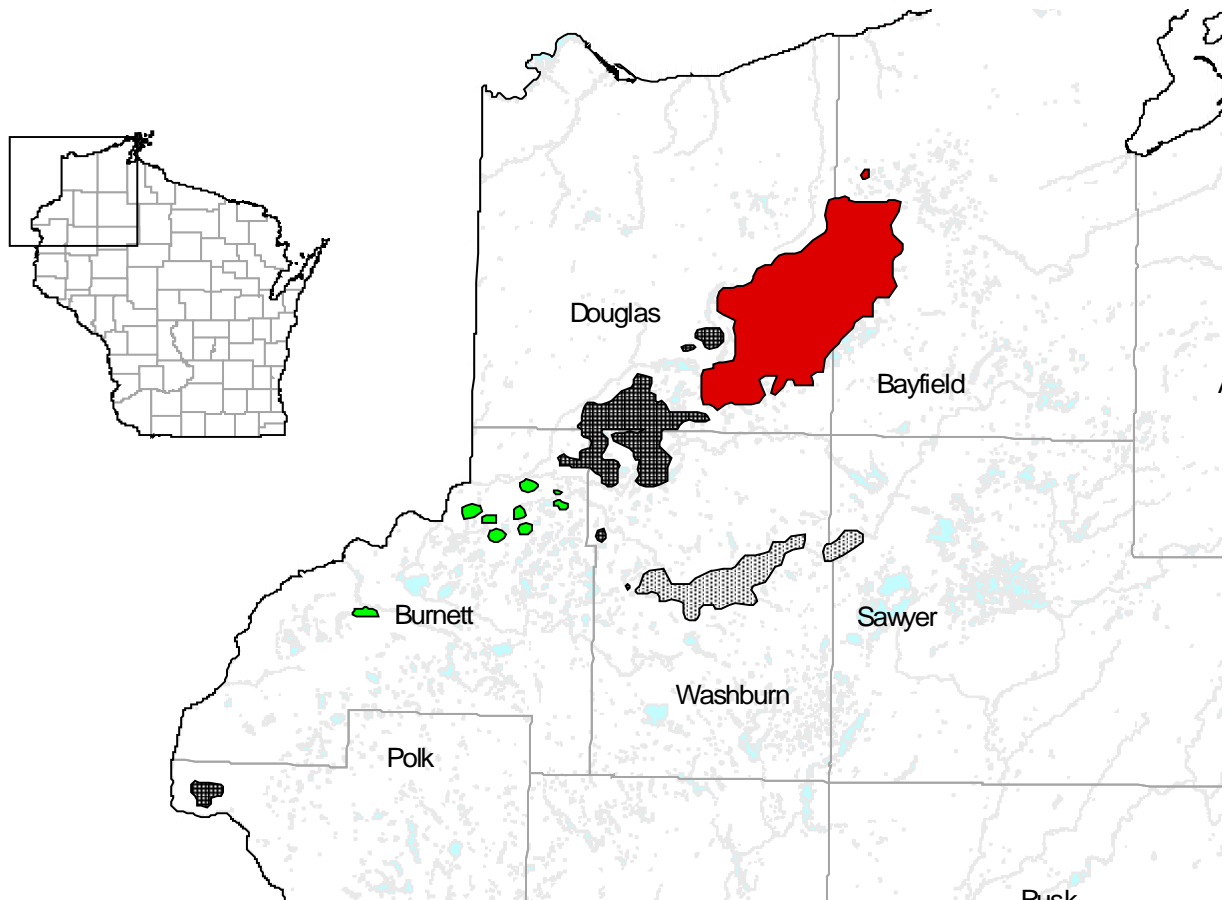
Jack Pine Budworm

Northwest Wisconsin

Budworm populations skyrocketed in 2005 in northwest Wisconsin. Acreage defoliated increased from 36,700 acres in 2004 to 222,500 acres in 2005. Defoliation was widespread and higher in all 6 counties that have jack pine.

County	2004 acreage	2005 acreage
Polk	0	4,000
Burnett	4,100	10,000
Sawyer	0	3,000
Washburn	6,400	48,000
Douglas	23,700	113,000
Bayfield	2,500	44,500
Total	36,700	222,500

There were only mild surprises in the 2005 outbreak. The 4,000 acre spot in Sterling township appeared a year earlier than expected based on surveys. The defoliation in Burnett County was less extensive and less severe than anticipated. Washburn County was severely affected, more than expected. Defoliation was light to moderate in the Minong area; much of the severe defoliation with associated mortality occurred in Springbrook township. The extent and severity of jack pine budworm defoliation is expected to decline in 2006 in northwest Wisconsin.

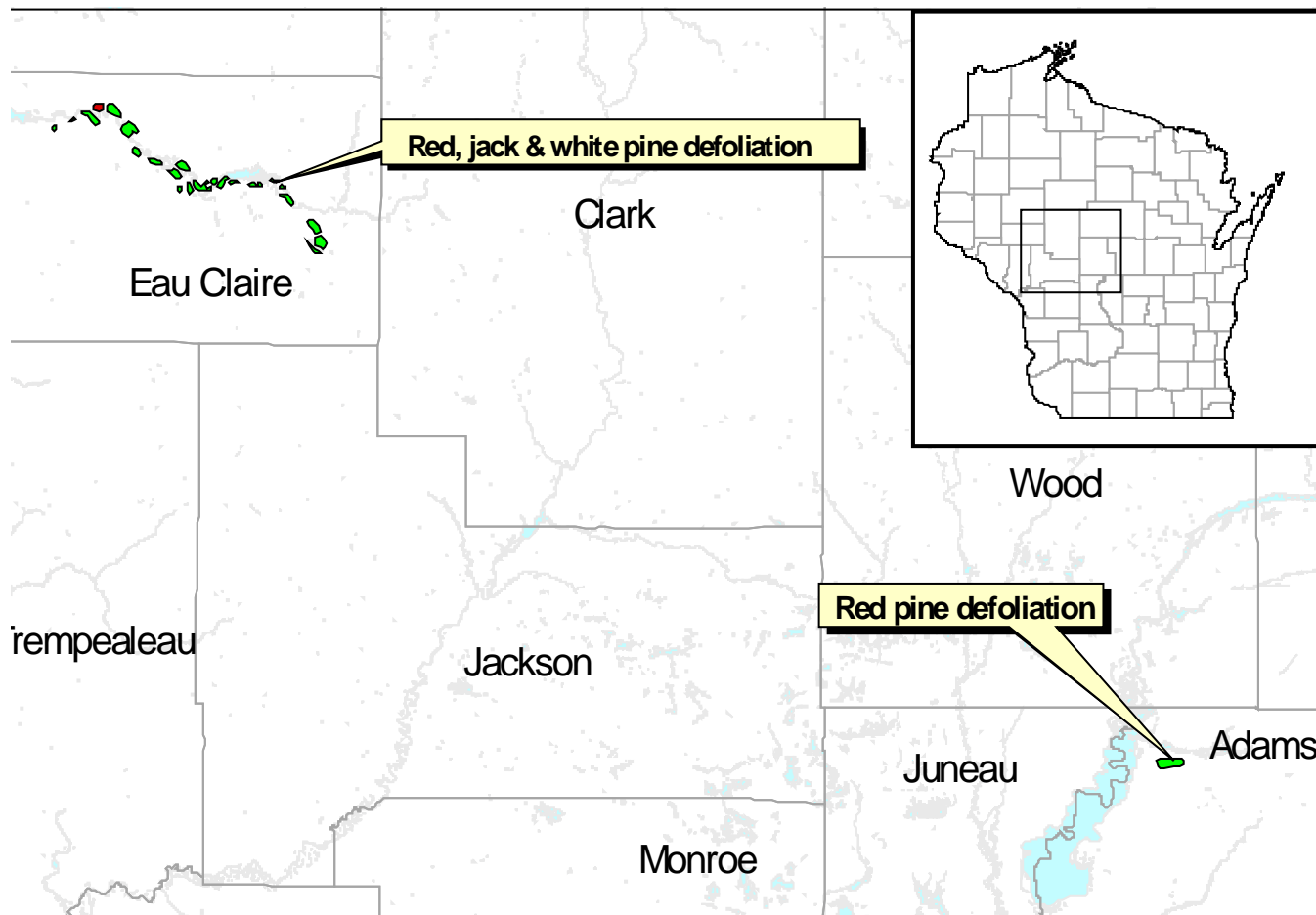


West Central Wisconsin

In the west central region, jack pine budworm is currently active in Adams and Eau Claire counties, where defoliation varies from light to heavy, and in Juneau, Marathon and Wood counties where defoliation varies from light to moderate. Populations are increasing in some counties and, based on egg mass surveys, defoliation is expected to occur again in 2006. Budworm is also feeding in red pine stands. In both jack and red pine, there is top kill and entire tree mortality with bark beetles killing severely stressed trees.

The budworm in red pine acts in a manner opposite to its activity in jack pine. Normally, budworm does not feed in young jack pine stands (20-30 year old), but in older stands (30+ year old), you will often find heavy defoliation on most trees with sporadic healthy pines. In red pine, on the other hand, larval feeding is widespread in young stands, and occurs only sporadically in older plantations (35+ year old).

This is the second year that jack pine budworm has been observed in red pine in Adams County with budworm spreading further into these stands (younger and older). Budworm has also been observed in young red pine stands (20-30 year old) in Eau Claire, Juneau, and Wood counties and in older red pine in Wood County. In Minnesota, budworm has been observed in red pine for the past 3 years.



Hickory Decline and Mortality

Symptoms of hickory decline



Thinning and dead crowns



Wilting leaves

Severe decline and mortality of hickory has been observed from southern to northeastern Wisconsin. Most of the mortality was of bitternut hickory, but there was some mortality of shagbark hickory as well.

The symptoms progress from thinning crowns to branch mortality to complete tree mortality. Epicormic branches often sprout from the main stem only to wilt and die later.

Some of the pests that have been associated with dying hickory trees include a bark beetle, a flatheaded borer, and possibly fungi that cause canker and wilt diseases. The hickory bark beetle (*Scolytus quadrispinosus*) is believed to introduce a canker fungus (*Ceratocystis smalleyi*), which creates oblong sunken cankers with discoloration under the bark. A flatheaded woodborer (*Agrilus otiosus*) was also observed attacking these declining and dying trees although it is not clear if this flatheaded woodborer is the primary cause of decline or is secondary.



Exit hole of *A. Otiosus*

Additionally, there may be a fungal disease associated with dying trees that causes wilt (*Ceratocystis caryae*), in which the affected trees have dead crowns with wilted epicormic branches. Armillaria root disease was also found in the roots of dead hickory trees in some sites, but in other sites, there was no Armillaria. Armillaria was not found in the northeast part of the state where hickory in Calumet, Shawano, and Oconto counties were most affected.

Tamarack Mortality in Southeastern Wisconsin 2005

Mark Guthmiller
Plant Pest and Disease Specialist
Wisconsin Department of Natural Resources

Tamarack is a common component of our wetland areas in many parts of Wisconsin. Reports of tamarack mortality have been periodically reported. The cause of mortality has often been associated with fluctuating water levels as well as pests such as the larch sawfly, eastern larch beetle, and larch casebearer. In 2005, additional locations of tamarack mortality were reported. This prompted aerial and limited ground surveys to look at the extent and cause of mortality in southeast Wisconsin. This report summarizes the finding of these ground and aerial surveys.

Aerial Survey Results

Aerial surveys were conducted to determine the level of tamarack mortality in stands in eastern Wisconsin. Surveys were conducted on October 26th in southeastern Wisconsin and on November 2nd in southern part of northeastern Wisconsin. Needles had started turning yellow but had not yet dropped. Over 7,000 acres comprising 48 different stands of tamarack were surveyed by air and rated for percent mortality using visual estimations. A rating system was established using the following codes for mortality: A= 0-5%, B= 6-25%, C= 26-50%, D= 51-75%, E= 76-100%

Of the 48 stands the summaries by category are:

14 stands, ~1,670 acres, A = 0-5% mortality
18 stands, ~2,765 acres, B = 6-25% mortality
8 stands, ~840 acres, C = 26-50% mortality
3 stands, ~245 acres, D = 51-75% mortality
5 stands, ~2,130 acres, E = 76-100% mortality

The stands with highest percent mortality were located in Sheboygan, Washington, and Ozaukee Counties. Within these three counties a few small stands of tamarack looked healthy.

Ground Survey Results

Town of Addison, Washington County:

This site was a small (<50 acre) stand of tamarack. Mortality was close to 100% with a few small (< 5" dbh) living tamarack. The site was visited on August 22nd, 2005 and stand conditions were very dry at that time. There was landowner concern that a nearby berm was diverting water from his property.

Findings included eastern larch beetle on some of the dead trees. Not all the trees appeared to be infected by larch beetle. This beetle appeared to be more common on the periphery of the stand than the interior of the stand. Numerous conks of the heart rot fungus, *Fomitopsis pinicola* (red banded polypore), were observed on a number of trees. Extensive root rot (80%) was observed on one live 4" dbh tree. The fungus, *Leptographium sp.* was associated with both the decayed roots and larch beetle galleries at this site.

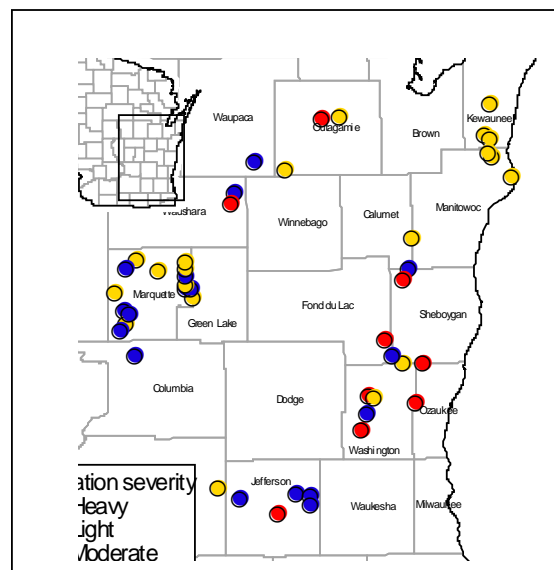


Fig. 1. Aerial survey map of tamarack stands modified to light, moderate and heavy mortality levels.



Figure 2. Conks on tamarack.

Pike Lake State Park, Washington County:

Scattered European larch in an upland setting and scattered native tamarack near a pond at Pike lake state park were observed. The European larch were experiencing top kill and the native tamarack were experiencing scattered mortality.

Findings on the European larch included eastern larch beetle attacking the upper crowns and the red banded polypore, *Fomitopsis pinicola*, was observed on the main bole below the larch beetle attack. The native tamarack were experiencing a number of signs and symptoms including heavy resin flow on the main bole, canker-like decay on the bole and root flare, the heart rot fungus, *Phellinus pini*, eastern larch beetle and the fungus, *Leptographium sp.* associated with beetle galleries.



Figure 3. *Phellinus pini*

Kettle Moraine State Forest, Northern Unit, Fond du lac County:

This site was a small (<100 acre) tamarack stand with extensive mortality. A few smaller diameter trees were still alive. Site conditions were very dry at the time of the survey. The findings at this site appeared to be primarily eastern larch beetle attacking the trees. In addition, *Leptographium sp.* and *Oedocephalum*, which is the asexual stage of the fungus, *Heterobasidion annosum*, were isolated from samples at this site.

Gilbert Lake, Washington County:

This site was a small tamarack stand bordering the edge of Gilbert Lake. Most of the trees closest to the lake appeared healthy. There was scattered mortality to the tamarack on the outer periphery of the stand farthest from the lake. The water level was extremely low to non-existent in the outer periphery. Live trees adjacent to dead showed yellowing and browning of needles possibly due to desiccation.

Cedarburg Bog, Ozaukee County:

The Cedarburg bog is a very large area encompassing all or parts of 7 sections in Ozaukee County. An aerial survey of Cedarburg bog indicated greater than 75% mortality of all Tamarack within the bog. The ground survey location



Figure 4. Aerial survey of tamarack mortality at Cedarburg Bog.

was picked where access and knowledge of live trees were present. Within this survey area six trees were sampled and checked for numerous insect and disease agents. Determining if trees were dead or alive was problematic as needles had already dropped for the season. Five of the six trees were also sampled for laboratory diagnostics. All roots sampled had some level of decay. Roots were resin soaked with decay in the cambial region. Three of the five trees sampled were positive for *Leptographium sp.* *Leptographium* appeared to be directly associated with larch beetle galleries. *Leptographium sp.* is a black stain fungus of conifers. The species, *Leptographium penicillatum* has been previously reported in the literature on Tamarack. Its role, if any, in tree

mortality is unknown. Canker like wounds with resin pitch were also sampled and the cause did not appear to be directly related to bark beetle activity and may require further investigations.

UW field station director, James Reinartz, made observations at the Cedarburg bog including drought that existed in fall of 2003 with dry peat conditions and water levels lower than normal. Tamarack seemed to survive better near edges of the bog with mineral soils. In addition to drought there was deep frost with no snow cover in the winter of 2003-2004. In spring of 2004, tamarack leafed out like normal then many of the trees turned brown by mid-spring.

The extensive mortality at Cedarburg bog and elsewhere may have been caused by a combination of drought, freeze injury to the roots followed by a build up of and attack by larch beetle in stressed trees that did not die directly from drought or freeze injury to the roots.

Annosum update and activities 2005

Kyoko Scanlon, Forest Pathologist

Confirmed Counties with Annosum Present

In 2005, Annosum root rot was found in a red pine stand in Waushara County (yellow on map). This brings the total number of counties with this disease to fourteen (Adams, Buffalo, Dunn, Green, Iowa, Jefferson, LaCrosse, Marquette, Richland, Sauk, Trempealeau, Walworth, Waukesha, and Waushara Cos.). The map on the right shows the county distribution of Annosum root rot as of December, 2005.



Annosum Planting Trial

In November of 2003, approximately 13 acres of a red pine plantation in the Sauk County Forest (T8N R3E Sec. 7) were clearcut as a salvage operation due to extensive Annosum root rot (*Heterobasidion annosum*) infections. Prior to planting, the stand was divided into burn and non-burn sections to evaluate the effectiveness of prescribed burn on the regeneration success in a stand with Annosum root rot. In December, 2004, a prescribed burn was conducted with less than ideal burn results.

On the first week of May, 2005, a variety of coniferous and deciduous tree seedlings were hand planted in the stand. Eight 40' x 40' microplots were established within the stand to evaluate the short-term seedling survival of various tree species in the Annosum infected stand. Half of the microplots were placed where prescribed burn was conducted while others were located where prescribed burn was not attempted. Half of the microplots were established in the middle of an Annosum infection center, and the other half were placed away from any of the infection centers. Each microplot consisted of 12 rows, and each row was planted with 12 different tree species (144 seedlings per microplot). The order of 12 species within each row was selected randomly. Species planted in microplots were red pine, white pine, jack pine, white spruce, black oak, red oak, white oak, cottonwood, green ash, black walnut, hickory, and hackberry.



Due to the hot and windy condition during planting, and hot and dry weather before and after planting, mortality rate of the seedlings was very high. By early July, the average mortality rate was 34% in the microplots. Mortality rate for conifers was over 60%. There was no significant difference in mortality rate between the plots inside and outside of Annosum infection centers. The stand, including the microplots, is scheduled to be re-planted in the spring of 2006.

Chequamegon-Nicolet National Forest Oak Wilt Suppression Project

Surveys and out-reach

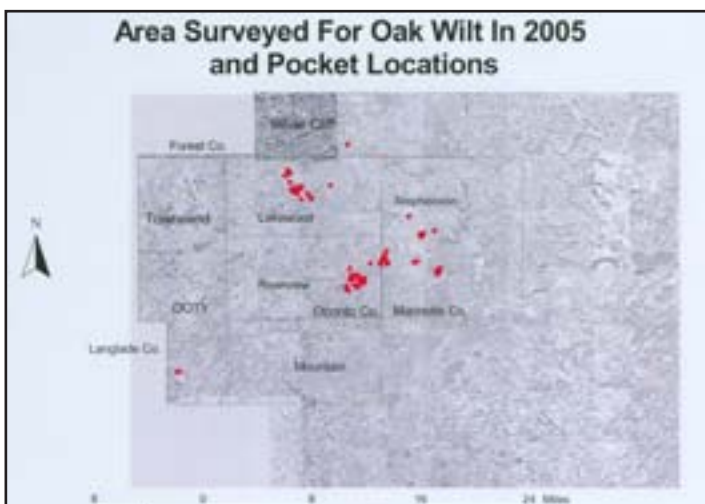
Erik Lund, Forest Health Specialist

DNR, Antigo WI

Introduction

In the summer of 2005, surveys for oak wilt were conducted on private lands within and just outside the boundaries of the Lakewood/Laona Ranger District Chequamegon-Nicolet National Forest in Oconto and Marinette counties. The Forest Service had conducted ground/aerial surveys in 2003-2004, and had located 60 potential oak wilt pockets on private lands within the forest. Most of these pockets were located around the Crooked and Waubesa Lake area, within the Townships of Riverview and Lakewood in Oconto County.

In 2005, the Wisconsin DNR received federal funding to conduct the surveys and to develop a cost-share program for private landowners. The main purpose of the program is to reduce the number of oak wilt pockets on private and federal lands in Oconto and Marinette counties.



The Surveys

The initial surveys were conducted in June of 2005. Sites that had previously been identified through aerial surveys as potential oak wilt pockets were surveyed to determine pocket location and size. Currently infected oaks were not yet showing symptoms of oak wilt but the presence of several dead trees indicated pocket location. Through this initial survey, 60-70 probable oak wilt pockets were located. These sites were later re-examined when newly infected oaks would be showing symptoms to be certain that active oak wilt was present. A newsletter was sent to landowners in Oconto County who had pockets on land that they owned or land adjacent to their property. The newsletter addressed some of the issues with oak wilt and what is currently being done to try to stop the spread.

The second survey occurred in early July when newly infected trees began to show signs of oak wilt. The peak time for wilt symptoms occurred from mid-July to mid-August. During these surveys, areas that had already been identified as well as areas showing new signs of oak wilt were examined. A total of 104 sites were identified to have oak wilt. Most of these sites were located in Oconto County, with about 25 pockets located in Marinette County. Coordinates for all pockets were marked with GPS. Landowners were contacted and advised regarding the best way to manage disease. These surveys were located in close vicinity to areas where oak wilt pockets had been identified through aerial surveys or by the Forest Service.

The last survey concentrated on areas within Oconto County that had not been surveyed previously. Most of these areas were around the lakes in the county because this is where most of the private land is located inside the national forest. In these surveys, no oak wilt pockets that were not previously identified were found.

Only 11% of the oak wilt pockets were in rural settings and 89% of the pockets were in urban settings. Most of

the pockets were in the yards or on the edge of yards of landowner's cabins and homes. It appeared that roughly 92% of the sites would be able to handle a vibratory plow if that was desired, though there may be underground wires or septic systems that may be prohibitive of such a treatment in the yards.



Conclusion

Private property in the northern half of Oconto County inside the boundaries of the National Forest has all been surveyed. Locations of oak wilt pockets have been mapped so they can be located and treated in the future. A list of all the landowners and how they felt about managing the disease was also compiled and updated. The far western edge of Marinette County was surveyed although not as extensively as Oconto County. If surveys are conducted in the future, Marinette County would be a good place to start as oak wilt was observed throughout the western half of the county. A few areas on the eastern portion of Langlade County were also surveyed, and no oak wilt was found in that area. With the combined effort of the U.S. Forest Service and the Wisconsin DNR, steps have been taken to slow the spread and reduce oak wilt in the area. In order to slow the spread of oak wilt, a cooperative relationship between government agencies, private consultants, and landowners is essential. Since most of the pockets are located within landowners' yards, education related to the disease and management options is a high priority. The U.S. Forest Service has reported that 85% of the area treated last year showed no sign of oak wilt this year.

Emerald Ash Borer (EAB)

Agrilus planipennis

Renee Pinski, Plant Pest and Disease Specialist, Madison



Adult emerald ash borer

Visual Survey of Private and County Campgrounds 2005

The emerald ash borer is an exotic woodborer from Asia and is a highly destructive pest of ash trees. EAB is responsible for killing an estimated 15 million ash trees in Michigan, Ohio, Indiana and southern Ontario since it was first discovered in 2002. The emerald ash borer has not yet been found in Wisconsin, however early detection of this pest is vital to maintaining the health of our ash resource.

In 2004 we began conducting visual surveys for EAB by looking at the ash resource in our state park and state forest campgrounds. In 2005, we expanded our visual survey efforts and included both private and county campgrounds. Due to the large number of private campgrounds in Wisconsin (~ 1,000), we choose to focus our efforts in the campgrounds located in the northeastern and southeastern parts of the state. These areas are at a higher risk for EAB introductions due to their larger civic populations and higher density of ash trees.

We targeted our survey efforts on the ash resource present in campgrounds because the risk of emerald ash borer infestation is increased for areas where non-local firewood is burned. The dispersal of EAB is known to be accelerated beyond its natural rate of ½ - 2 miles annually by the inadvertent transportation of larvae in logs, firewood and nursery stock. When surveying for EAB, data were collected by visually inspecting an ash tree for the presence of branch dieback, yellow foliage, epicormic sprouting and woodpecker feeding. These symptoms are commonly (although not definitively) associated with an EAB infestation. Additional data collection included visual inspection for any of the signs commonly associated with EAB which include the presence of larvae and/or adult beetles, bark cracks, serpentine galleries under the bark and D-shaped exit holes.

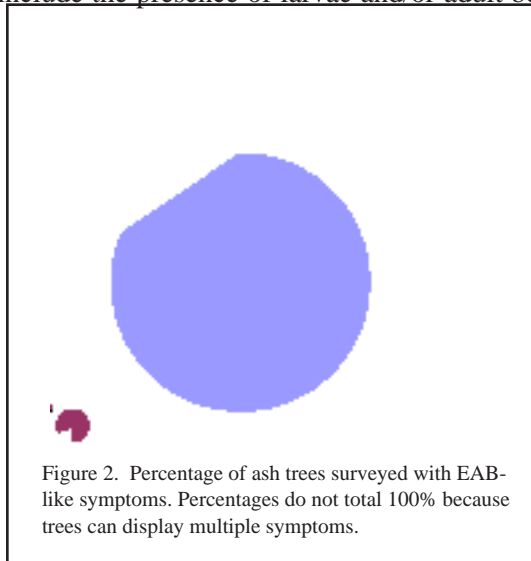


Figure 2. Percentage of ash trees surveyed with EAB-like symptoms. Percentages do not total 100% because trees can display multiple symptoms.

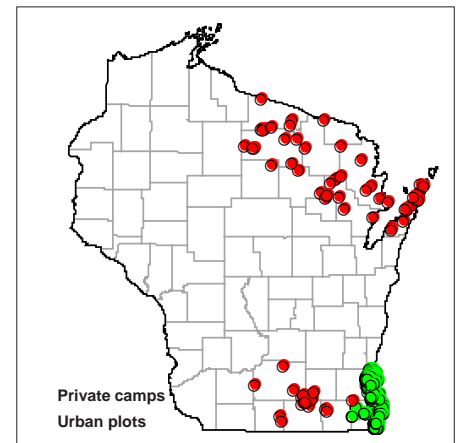
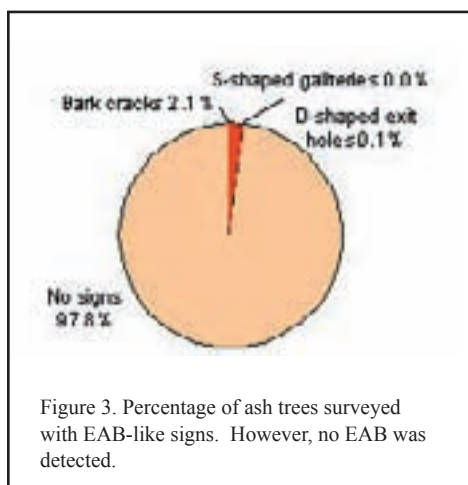


Figure 1. Map of Wisconsin showing private campgrounds and urban sites surveyed in 2005. Campgrounds that did not contain ash trees are not depicted.

As a result of our surveys, we detected no emerald ash borer infestations as of August 11, 2005. A total of 101 campgrounds were visited (Figure 1) and 2447 trees surveyed. Campgrounds were located throughout Dane, Door, Forest, Green, Jefferson, Langlade, Marinette, Oconto, Oneida, Rock, Vilas, Walworth and Waukesha counties. Overall, nearly 96% of the trees surveyed were seemingly healthy (Figure 2). A significantly smaller percentage of the trees exhibited branch dieback (12.5%), epicormic sprouting (7.8%) and woodpecker feeding (1.2%). Only four of the trees had yellow foliage and 13 were dead. None of the dead trees exhibited EAB's

serpentine galleries or D-shaped exit holes.



Our surveys also found nearly 98% of the ash trees void of EAB-like signs (Figure 3). A small percentage of the trees exhibited bark cracks (2.1%), however there were no serpentine galleries visible beneath. Just two trees displayed D-shaped exit holes, but they measured much smaller than the 1/8" diameter characteristic of EAB. We did not find EAB during our visual surveys, however it has been documented in Michigan that it is possible (and quite common) for EAB to be present in a tree 3-4 years before visual inspections will detect the infestation. Therefore, we have decided to conduct precautionary follow-up visits to trees that exhibited three or more of the EAB-like symptoms and signs mentioned above. We found a total of 92 trees with three or more symptoms and signs, thus flagging those trees for follow-up visits in 2006.

The overall status of the ash resource in Wisconsin's private and county campgrounds is generally healthy. This conclusion parallels what we found during our EAB visual surveys in 2004, when we surveyed the ash resource in state park and state forest campgrounds. During the 2005 survey we did observe some minor ash pests and pathogens. The foliar disease anthracnose was reported on 1.9% of the ash trees surveyed, while less than one percent of the trees surveyed had ash bark beetles, scale insects, ash plant bugs, ash flower gall mites or ashleaf gall mites.

We will continue to survey Wisconsin's ash resource for EAB in subsequent years. Our plans for 2006 include a visual survey of private and county campgrounds in north- and southwestern Wisconsin. We also plan on setting up EAB detection trees throughout some of the most visited state parks in Wisconsin.

Urban Ash Surveys in Southeast Wisconsin

During June and August of 2005, visual surveys for emerald ash borer were conducted in urban areas of Kenosha, Milwaukee, and Racine Counties (see map on previous page) Work was done by personnel from the University of Wisconsin under the direction of Dr. Chris Williamson.

Ash trees were examined for general signs of vigor in addition to signs of emerald ash borer infestation. A total of 2,323 trees were examined (nearly all were black, green, or white ash). Only one tree was dead. Of live trees, 60% showed no sign of weakness or injury, 32% exhibited branch dieback, 11% epicormic branching, 3% had a bark crack, and 2% had yellow leaves. (Numbers add to greater than 100% because trees may have multiple symptoms). One tree had a D-shaped exit hole that was attributed to an insect other than emerald ash borer. **No emerald ash borer larvae, galleries, or adults were detected by these surveys**

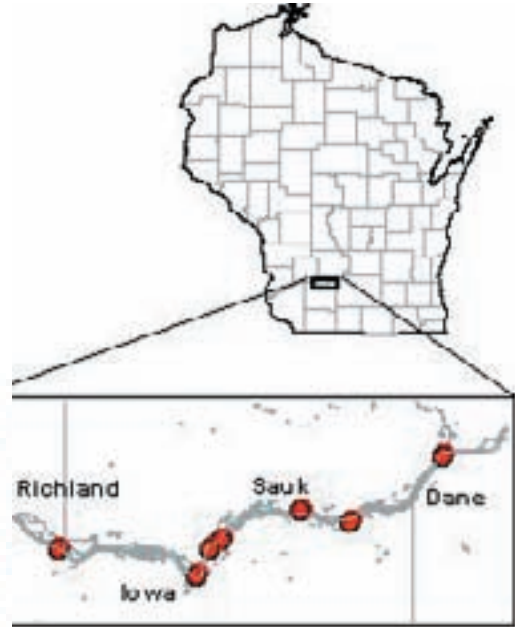
Signs of reduced vigor were attributed to several causes. In order of importance, these included wound damage, girdling, recent or improper planting, and water stress. The most common insect and disease problems were due to other wood-boring insects, galls, ash flowergall mite, anthracnose, white peach scale, European fruit lecanium, and wooly ash aphid.

Detection Tree Survey

In addition to conducting visual surveys for emerald ash borer (EAB) (*Agrilus planipennis*) in 2005, we set up and monitored detection trees along the Lower Wisconsin Riverway (LWRW) with the help of LWRW forester Brad Hutnik. The LWRW is a flood plane forest scattered with numerous sandbar islands. This area is frequented by recreational canoe use and overnight camping. Due to the nearly nonexistent supply of firewood for campers, firewood is often brought into the area. It is through this gateway that EAB could possibly be introduced into Wisconsin.

Site selection

We selected seven sites for detection tree placement along a 23 mile stretch of the LWRW between Mazomanie Beach in Dane County (latitude N 43.23463°, W -89.80737°) and Long Island in Richland County (N 43.16723°, W -90.19702°). Detection tree placement was based on four criteria to optimize our sampling efforts (most to least important): 1) Close proximity to camping, 2) Declining ash trees nearby, 3) Open-grown trees, and 4) Site accessibility. Two detection trees were placed at each of the seven sites. Sites were 1-5 miles apart and trees within a site were placed 100 – 200 feet apart. Detection tree construction consisted of girdling an ash tree (6-10" DBH) at waist height and placing a band of tangle trap above the girdle. The tangle trap was monitored biweekly from late May to early August. Monitoring consisted of looking for both EAB and other wood boring insects and removing them for identification. It has been found from past work in Michigan that tangle trap alone cannot always detect a low density EAB infestation, therefore detection trees will be felled during late winter 2006 and their bark peeled back to look for EAB larvae.



Insect catch from detection trees 2005

There were no EAB findings from the tangle trap on our detection trees in 2005. However, numerous other wood borers were collected. Of particular



Detection tree construction

interest were two longhorn beetles (Cerambycidae), the redheaded ash borer (*Neoclytus acuminatus*) and the banded ash borer (*Neoclytus caprea*). Both were collected from the majority of detection trees and are commonly associated with stressed ash trees. In addition, numerous metallic wood borers (Buprestidae) were collected, with none being EAB. A species of *Chrysobothris* was collected as well as four species of *Agrilus*. Emerald ash borer is part of the genus *Agrilus*. All Buprestidae are of interest and are being processed for identification.

Insect catch from detection trees 2004

A similar detection tree survey was completed in Wisconsin's state forest campgrounds in 2004. As in 2005, there were no EAB findings. We did however collect eight other species of Buprestidae. Four of the species are not classified in the same genus as EAB and include *Chrysobothris femorata*, *Anthaxia viridifrons*, *Anthaxia inornata* and *Dicerca divaricata*. The remaining four species identified were *Agrilus*, and include *A. granulatus liragus*, *A. cephalicus*, *A. masculinus* and *A. crataegi*. All *Agrilus* identified are thought to prefer non-ash hosts. Identification of the Buprestidae collected is beneficial to understanding our native beetle fauna for two reasons: 1) we have little knowledge regarding Wisconsin's native Buprestidae fauna and 2) it will allow us to discern the impact that EAB's presence will have on our native species in the future.

EAB Firewood Inspection Blitz at Ferry Docks

Linda Williams, Forest Health Specialist, Northeast Region

The United States Dept. of Agriculture Animal, Plant, Health Inspection Service (APHIS) conducted a special inspection for firewood (referred to as a blitz) at the two ferry docks preceding the Fourth of July weekend to enforce the quarantine against movement of hardwood firewood out of Michigan's Lower Peninsula. Wisconsin sent people from the Wisconsin Department of Natural Resources, and University of Wisconsin to assist with this firewood blitz. Two ferries cross Lake Michigan, bringing vehicles that could be carrying regulated firewood out of Michigan to other states. Wisconsin is at particular risk for infested firewood since Wisconsin is the destination for many of the ferry travelers. The ferries were already screening vehicles for fireworks, explosives, and weapons, we simply added to this with the question "do you have any firewood". For those people who wanted more information about EAB we provided them with the brochure Emerald Ash Borer The Green Menace for their reading pleasure during the ferry crossing.



Inspection for ash firewood at ferry docks.

The SS Badger, which leaves twice daily from mid-May through mid-October, holds 180 vehicles and 620 passengers and is large enough to take semi-trailers, recreational vehicles, motorhomes, and farm equipment, as well as standard passenger vehicles. The Lake Express, located in Muskegon, Michigan, departs 3 times daily during the summer season and holds 47 vehicles with no space for large or oversized loads.

There was no firewood found at the Lake Express terminal, but two seizures of hardwood firewood occurred at the SS Badger site. No signs or symptoms of EAB were found in the wood that was seized. APHIS also conducted a firewood blitz at the ferries on the weekend prior to Labor Day and no firewood was confiscated at that time. Based on these inspections it appears that the ferries are not a high risk route for EAB infested firewood to enter Wisconsin.

Minor Issues

Oak wilt herbicide trial: 2005 Updates

Nine-Mile Recreation Area on the Marathon County Forests

An herbicide field trial was initiated in the Nine-Mile Recreation Area on the Marathon County Forest in 2003 as an alternative to physical root severing by a vibratory plow. Trees within grafting distance were



Girdled oak trees were treated with Garlon 4 in July 2003.

identified by using Johann Bruhn's model, and these trees were treated with Garlon 4 (active ingredient: triclopyr) in early July 2003, and additional trees were treated in early July 2004 (for the details of the treatment in 2004, please refer to [Forest Health Conditions in Wisconsin: Annual Report 2004](#), page 16, titled "Oak wilt Marathon County Control Trial: 2004 updates on the herbicide trial in the Nine-Mile Recreation Area on the Marathon County Forest").

In 2005, the site was closely monitored throughout the growing season. No additional trees exhibited the symptoms of oak wilt at the site. However, a new oak wilt pocket was found in the Marathon County forest,

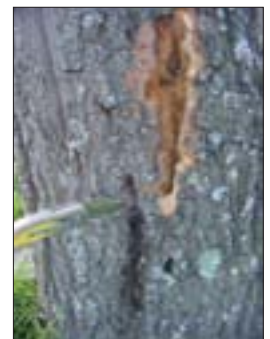
away from the original herbicide trial site. The site with the isolated oak wilt pocket will be treated with a herbicide in 2006. The original herbicide trial site will continue to be monitored through weekly visits by county forest personnel during the summer 2006.

We thank Doug Brown, a Marathon County Forester, for providing us with periodical updates on the trial.

Sudden Oak Death

Since the mid 1990's mortality of several species of oak has been detected in northern California. A new disease caused by a fungus-like organism *Phytophthora ramorum* has been identified and is now known to occur in 14 coastal California counties from Monterey to Humboldt, as well as in Curry County, Oregon.

The origin of this disease is unknown. It causes bleeding cankers on several trees including tanoak, coast live oak, California black oak, Shreve oak, and canyon live oak. Infected trees typically die several years after infection. This disease also causes leaf spots, and branch tip dieback on a wide variety of understory plants; in June 2005, the number of genera known to be susceptible to this disease was up to 39. Pathogenicity tests have shown that northern red oak, *Quercus rubra* is susceptible.

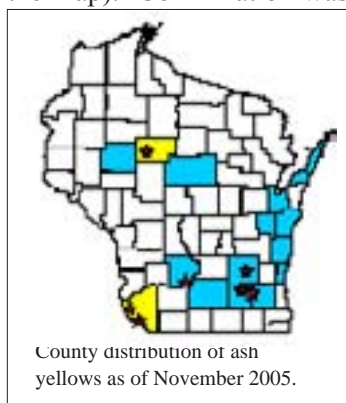


Bleeding canker associated with Sudden Oak Death.

In 2003, plant inspectors found that nursery stock had been shipped from an infected nursery in southern CA to several states, including WI. This prompted a national survey in 2004 and 2005 of nurseries receiving this stock and the oak woodlands surrounding these nurseries. Dr. Neil Heywood, a UW Stevens Point professor from the Department of Geography & Geology and his students conducted this survey. In 2005, DATCP surveyed nurseries and Dr. Heywood surveyed oak woodlands within 0.25 mile of 22 selected nurseries and 8 oak woodland sites. Samples (75) included understory vegetation with leaf spots resembling those caused by *P. ramorum* and tissue from bleeding oak

Ash Yellows

Ash yellows, caused by a phytoplasma, was confirmed in Grant and Taylor Counties in 2005 (shown in yellow on the map). Confirmation was made by a genetic analysis using a PCR (polymerase chain reaction) test. Samples



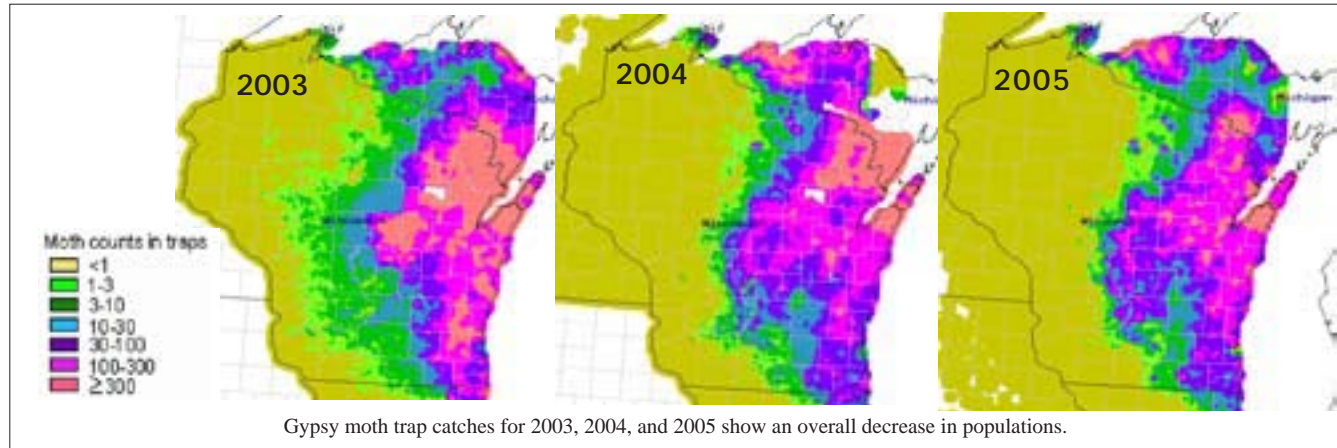
were collected from 8 locations where ash dieback had been reported in order to test for ash yellows. The analysis revealed the existence of the organism for 7 out of 8 locations (positive sites are shown as a star on the map). Some of the sampled trees that were positive for ash yellows were not showing the characteristic symptoms of ash yellows, such as brooms, yellowing foliage, or deliquescent branching. However, all of the positive trees exhibited branch dieback (or mortality) and epicormic branches. Positive locations included a campground, yard, woodlot, and forest. For more information about the PCR test, please refer to Ash yellows PCR test results: 2005, under Special Reports section.



Branch dieback caused by ash yellows

Gypsy Moth

Gypsy moth populations remained well below their 2002-03 highs because of a population collapse in 2004. As a result, the 2005 suppression program was a fraction of its size the previous year. Approximately 2,700 acres in 5 counties were successfully treated. This compares to about 51,000 acres in 20 counties treated in 2004. There



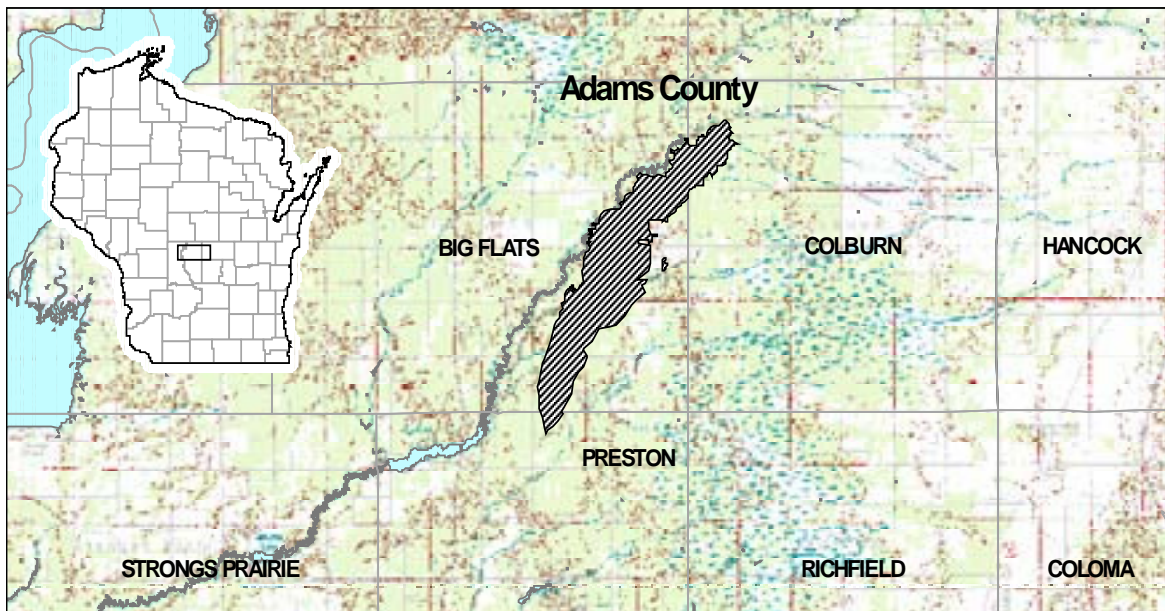
was no large-scale defoliation this year. Approximately 20 acres were defoliated in 2004 and 65,000 acres in 2003. Scattered trees in Armstrong Eddy Park, Beloit, were heavily defoliated.

The summer of 2005 was warm and dry, leading to increased caterpillar survival and increased average egg mass size. As a result, caterpillar numbers are expected to increase several-fold in 2006. The greatest impacts are expected in Adams, Columbia, Dane, Marathon, and Sauk counties. In eastern Wisconsin, populations are also expected to increase, but widespread outbreaks are not expected.

Trapping data (available at <http://da.ento.vt.edu/results0.html>) indicated that the generally infested area did not increase in size. Juneau and Sauk counties were added to the list of counties quarantined for the gypsy moth.

The Cottonville Fire: Consequences for Forest Health

The Cottonville fire occurred on May 5, 2005 and covered 3,410 acres. Many of the effects of the fire on forest health were apparent one month following the fire. Bark beetles (*Ips pini*), red turpentine beetles (*Dendroctonus valens*), and white-spotted pine sawyers (*Monochamus scutellatus*) were already moving into fire-damaged stands of white, red and jack pine. These beetles are known to attack stressed or dead trees. Mild drought during the summer



The Cottonville fire in northern Adams County covered 3,410 acres.

months may have exacerbated these effects. By September the combined effects of drought and fire damage led to a major outbreak of white-spotted pine sawyer and much of the pine was salvaged. Jack pine budworm was observed

Other Pests Reported in 2005

Pest	Host	Damage	Location
Abiotic			
Winter freeze/drought	Eastern Larch	Browning of needles, premature defoliation due to drought	Oconto, Door counties
Alder			
Striped Alder Sawfly (<i>Hemichroa crocea</i>)	Red Alder	Defoliation	Eau Claire County
Ash			
Anthrachnose (<i>Gnomoniella fraxini</i>)	Ash	Leaves turned brown and curled, causing some premature leaf drop.	Chippewa County
Ash bark beetle (<i>Hylesinus spp.</i>)	White Ash	Mortality	Shawano County
Ash flowergall mite (<i>Aceria fraxiniflora</i>)	Ash sp.	Distorted gall formation of male flower clusters	Dane County
Ash leaf drop: Cause unknown	Green Ash	Early unexplained leaf drop	Winnebago, Brown, Shawano counties
Ash Plant bug	White and green ash	Stippling with some leaf drop	Present in Washburn county at reduced levels
Ash yellows (<i>Phytoplasma</i> like organism)	Green Ash	Decline	Shawano Co.
Oystershell Scale	Green Ash	Branch dieback	Brown, Winnebago Co's
Redheaded ash borer (<i>Neoclytus acuminatus</i>)	Black ash	Mortality	Marinette, Brown Co's

Pest	Host	Damage	Location
Forest tent caterpillar	Cherries	Numberous tents with low to moderate defoliation	Burnett and Polk counties
Ugly Nest Caterpillar (<i>Archips cerasivorana</i>)	Wild Cherries	Leaves webbed together, and defoliated.	Scattered WCR.
Christmas Trees			
Balsam Gall Midge (<i>Paradiplosis tumifex</i>)	Balsam Fir	Insect galls at the base of the needles.	Chippewa County
Drought/Armillaria Root Rot (Abiotic & <i>Armillaria mellea</i>)	Balsam Fir	Scattered tree mortality in plantation.	Chippewa County
Crab Apple			
Eastern Tent Caterpillar (<i>Malacosoma americanum</i>)	Flowering Crabs	Defoliation	Scattered WCR.
Elm			
Dutch Elm Disease (<i>Ophiostoma ulmi</i>)	Elm	Tree mortality.	Scattered WCR.
Fall webworm	Elm and alder	Minor defoliation	Present in northwest but lowest levels in 10 yrs
Willow flea weevil (<i>Rhynchaenus rufipes</i>)	Ulmus sp.	defoliating leaves	Rock County
Euonymus			
Euonymus caterpillar (<i>Yponomeuta cagnagella</i>)	Euonymus sp	Defoliated leaves	Dodge, Milwaukee and Rock counties
Hackberry			

Pest	Host	Damage	Location
Miscellaneous Pests			
Armillaria Root Rot (<i>Armillaria mellea</i>)	Various hardwood and conifer species.	Tree decline, leading to possible mortality.	Scattered WCR.
Fall Webworm (<i>Hypantria cunea</i>)	Various hardwood species.	Webbing over branches and defoliation.	Scattered WCR.
Multicolored Asian Lady Beetle (<i>Harmonia axyridus</i>)	Indoor pest problem.	Getting inside buildings a becoming a nuisance.	Scattered WCR.
Oak			
Botryosphaera canker (<i>Botryosphaeria dothidea</i>)	Burr Oak	branch tip dieback	Green Lake, Waushara Co's
Cynipid Wasps (Family <i>Cynipidae</i>)	Burr Oak	branch damage	Manitowoc Co
Frost injury	Quercus sp.	red brown dessicated shoots	Crawford, Dane, Grant, Green, Iowa and Richland Co.
Hedgehog galls (<i>Acraspis erinacei</i>)	White oak	Spongy round galls on leaves, leaf drop	Dane County
Jumping oak gall (<i>Neuroterus saltatorius</i>)	White Oak	Seed-like galls on leaves	Marinette, Dane and Rock counties
Kermes Scale (<i>Kermes</i> spp.)	Red Oak Saplings	Twig dieback.	Eau Claire County
	Northern pin oak	Twig and small branch dieback	Reduced incidence in the Northwest
Leaf Blister (<i>Taphrina</i> spp.)	Oak	Nectrotic blisters on leaves.	Adams County
Oak Apple Gall (<i>Amphibolips confluenta</i>)	Oak	Round gall growing on bottom of leaves.	Scattered WCR.

Pest	Host	Damage	Location
Birds	Red and White Pine	Damage to leaders and lateral branches.	Scattered WCR.
Brown Spot Needle Blight (<i>Mycosphaerella dearnessii</i>)	White Pine	Needle discoloration and premature needle loss.	Adams County
Eastern and Pine-Pine Gall Rusts (<i>Cronartium quercuum</i> & <i>Endocronartium harknessii</i>)	Jack Pine	Galls on branches and trunk, leading to general decline of trees. Some branch and tree mortality.	Scattered WCR.
European pine sawfly (<i>Neodiprion sertifer</i>)	Pines	Defoliation	Scattered throughout SER
Jack Pine Budworm (<i>Choristoneura pinus</i>)	Jack, Red, and White Pine	Light to heavy defoliation of overstory and understory pines, resulting in top dieback and tree mortality.	Adams, Eau Claire, and Juneau counties.
Pine Root Collar Weevil (<i>Hylobius radialis</i>)	White Pine	Girdling, mortality	Door Co.
	Red pine	Decline and death	Incidence declining in Washburn county
Pine Spittlebug (<i>Aphrophora parallela</i>)	Jack, Red, and White Pine	Spittle masses on the trunk and branches.	Scattered WCR.
Red Pine Pocket Decline	Pinus resinosa	Leptographium and drought causing mortality	Washington, Shawano, Brown, Outagamie counties; Scattered WCR.
Redheaded Pine Sawfly (<i>Neodiprion lecontei</i>)	Red Pine	mortality and defoliation	Marinette Co.
Sphaeropsis Shoot Blight and Collar Rot (<i>Sphaeropsis sapinea</i>)	Red and Jack pine	Stunted dead shoots and branch dieback	Waushara County, Scattered throughout WCR, SCR and SER; continues to kill surviving trees in hail damaged area in Douglas County, Very common on understory red pine and roadside jack pines in Northwest
Swiss needlecast (<i>Phaeocryptus gaumanni</i>)	Douglas fir	Brown tips on needles, needle loss	Waukesha County
Red Turpentine Beetle (<i>Dendroctonus valens</i>)	Red Pine	Weakens trees, Precursor to pocket mortality in thinned stands	Scattered WCR; Higher than average incidence in Washburn, Burnett and Douglas counties

Pest	Host	Damage	Location
Spruce budworm	White spruce and Balsam fir	Defoliation	Precipitous decline in Northwest in Spruce, Light defoliation in Brule valley on old balsam fir
Spruce needle drop (associated fungus: <i>Setomelanomma holmii</i>)	White spruce	Trees from which the fungus <i>S. holmii</i> was isolated exhibited chlorosis/necrosis of older needles, and needle drop	Jefferson County
Spruce Spider Mites (<i>Oligonychus ununguis</i>)	Black, Colorado Blue and White Spruce.	Needle discoloration.	Scattered WCR and Black Spruce in Mead Wildlife Area (Portage County).
White Grubs	White Spruce	yellowing and tree mortality	Waupaca Co.

Tamarack

Aphids (<i>Cinara</i> spp.)	Tamarack	Needle discoloration and formation of sooty mold.	Mead Wildlife Area (Portage County)
Larch Bark beetle	Tamarack	Mortality	Continuous to kill large tamarack in scattered pockets across Northwest.

Special Reports

Jack Pine Budworm

Survey Procedures and Results: 2005

Shane Weber, DNR Forest Entomologist
Dept of Natural Resources
Spooner, Wisconsin

Early larval survey

This survey is done on a yearly basis and is a key indicator of the presence of destructive budworm populations. Thirty shoots and staminate flowers that can be reached from the ground are checked for larvae. Since staminate flowers are often scarce, a majority of shoots are usually used. A high plot, considered sufficient to cause moderate to severe defoliation, is defined as any plot with a count of 10 or more infested shoots and flowers.

Early Larval Populations					
County	No. Plots	No. Infested Shoots	Infested Shoots/ Plots	No. High* Plots	% High Plots
Polk	15	58	3.87	1	6.7

Early Larval Population Trends											
No. Infested Shoots/Plot							% High Plots				
County	2001	2002	2003	2004	2005	%Change 2004-2005	2001	2002	2003	2004	2005
Polk	6.00	0.60	0.13	0.93	3.87	+316	26.7	0	0	0	6.7
Burnett	0.83	0.63	0.71	0.67	5.08	+658	0	0	4.2	0	25.0

Jack Pine Budworm Pupal Survey

This survey is also conducted annually and gives a good indication of the kinds and numbers of pupal parasites in the population as well as next year's population of jack pine budworm. It is done in July when most insects are in the pupal stage. Some adults may already have emerged, but empty pupal cases are collected and counted as emerged moths. At each stop, pupae are collected on a time basis. If five pupae are not found in five minutes, the collection is terminated. If five pupae are found in 5 minutes or less, the collection is continued until 25 pupae are found or until 15 minutes have elapsed. The time required to find 25 pupae is then recorded. Adults, parasites and non-emergence are recorded for each pupae.

2005 Pupal Survey

				Moths		Parasites		Not Emerged	
County	Total Pupae	Total Minutes	Pupae/Min	No.	%	No.	%	No.	%
Polk	141	105	1.34	70	49.6	66	46.8	5	3.6

Pupal Population Trends

County	2002 Pupae/min	2003 Pupae/min	2004 Pupae/min	2005 Pupae/min	%Change 2004-2005
Polk	0.28	0.11	0.67	1.34	100
Burnett	0.3	0.53	0.93	1.26	35
Washburn	0.11	0.52	1.1	2.28	107
Douglas	0.23	0.51	1.48	2.21	49

Jack Pine Budworm Parasite and Predator Complex

This survey involves a careful examination of all the budworm pupae collected which do not produce moths. Adult specimens are compared to a reference collection. Any unknown adults are sent to the University of Wisconsin for identification. Pupal cases from which nothing emerges are dissected to ascertain the cause of failure.

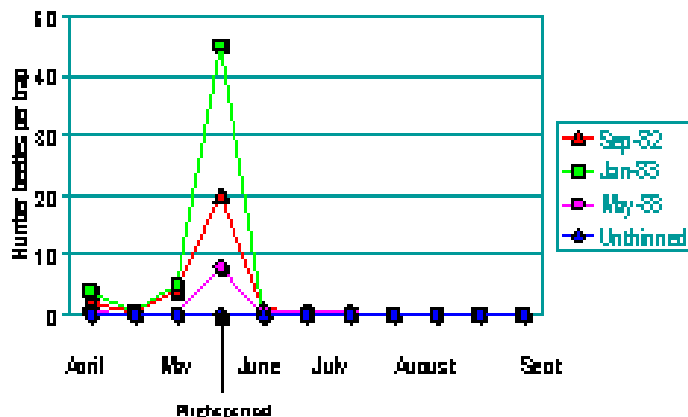
Parasite/ Predators	Polk	Burnett	Washburn	Douglas	Bayfield	Total	% of Para- sitized	% of Total
Itoplectes	14	28	46	133	67	288	28.9	10.9
Scambus	4	5	5	28	13	55	5.5	2.1

Time of year of thinning and the effect on populations of *Dendrotonus valens*

Sally Dahir
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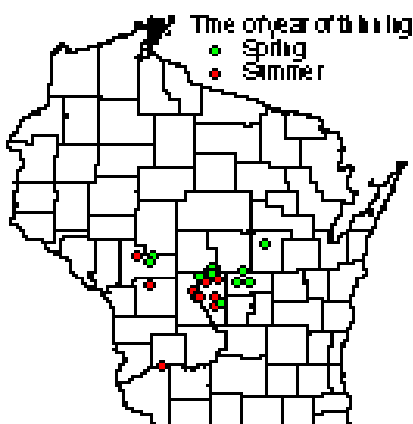


Red turpentine beetle (*Dendrotonus valens*) may be an important agent involved in the introduction of pathogenic fungi of the *Leptographium* genus into red pine stands, thus initiating a disease cycle called Red Pine Pocket Mortality. Studies from the western US indicate that stand disturbance or thinning may be correlated with the presence of bark beetles and infection with black stain fungi. For instance, in a study by Goheen & Hansen (1978), 80% of infection centers caused by *L. wagnerei* in Douglas fir occurred in disturbed sites. The time of year of thinning was also shown to be correlated with the presence of the beetle, *Hylastes nigrinus*. Witcosky et al (CJFR1986) observed an attack intensity of only 2.9 on Douglas fir stumps in stands thinned during June or July of the preceding year compared to 14.6 in stands thinned in Sept-Jan and recommend thinning in early summer to give slash the maximum amount of time to dry out.



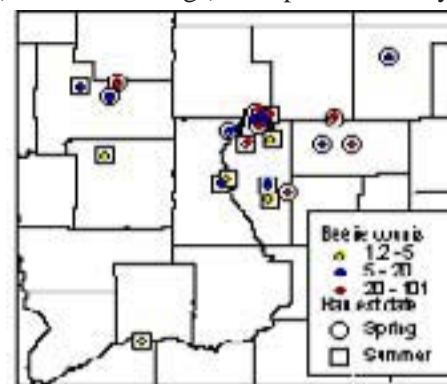
We wanted to test this hypothesis in Wisconsin; i.e.

would the time of year in which a red pine stand was thinned make a difference in the number of turpentine beetles



recovered in traps the following May. We selected roughly equal numbers of stands: 13 thinned in the summer (June through September 2004) and 10 stands thinned in the spring (February through April 2005) located mainly in the central part of the state (see map). Traps were made of gallon plastic milk jugs cut on 3 sides. A pheromone lure containing the chemical delta-3-carene was wired inside the jug and a plastic cup containing a pesticide strip was screwed to the mouth. The milk jug was then turned upside down and wired to the base of a red pine tree in the vicinity of a freshly cut stump. Traps were placed between April 18th and April 21st and collected between June 13th and June 17th. Counts of red turpentine beetles were averaged over all intact traps (several traps were destroyed presumably by animal activity).

The map on the right shows the results by category and beetle count. Notice that the circles (spring thinning) have predominantly red and blue dots illustrating higher counts and that the squares (summer thinnings) have predominantly yellow and blue dots which represent lower counts. The average number of turpentine beetles per trap for the stands harvested from June through November 2004 was 11.2 (stdev 9.2) and the mean for stands harvested February through March 2005 was 31.1 (stdev 29.3). A studentized t-test comparing the mean for the 2 groups showed a t-statistic of 2.068 with a 2-sided *p*-value of 0.065, a fairly significant difference between the 2 groups. There was much higher variance between the stands thinned in spring 2005



than those from the summer-fall of 2004. Part of this may be due to trap placement. Traps that were placed near

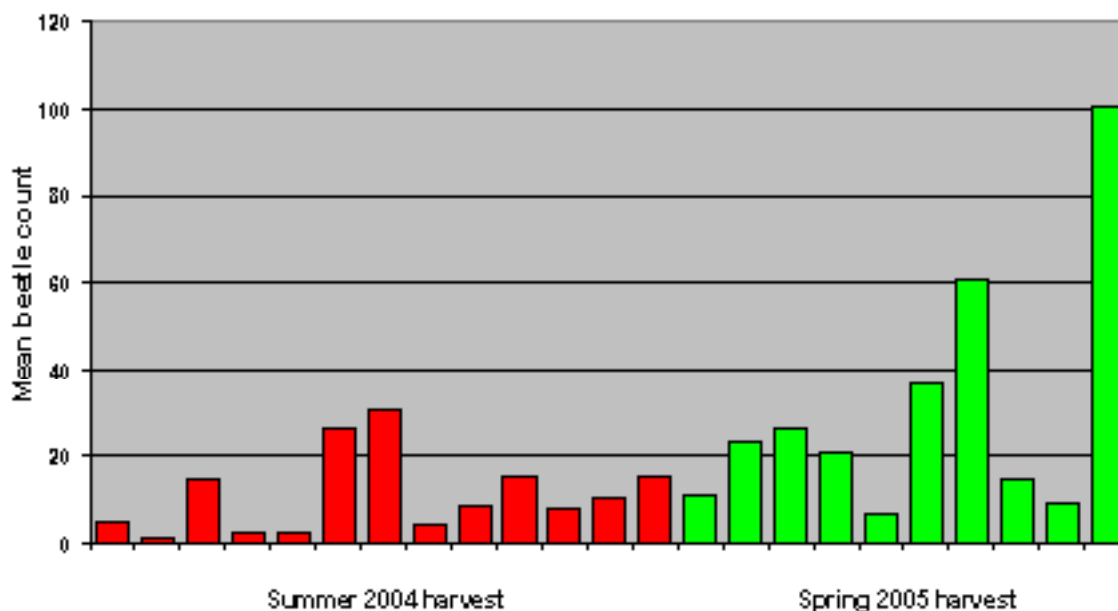


Figure 1. Per trap beetle counts were higher in the stands thinned in the spring of 2005 than those thinned in the summer and fall of 2004

edges that were exposed to open areas such as roadways and fields were more likely to have high beetle counts than those that were placed either in the stand interior or on edges which abutted forested areas (Figure 2). For example,

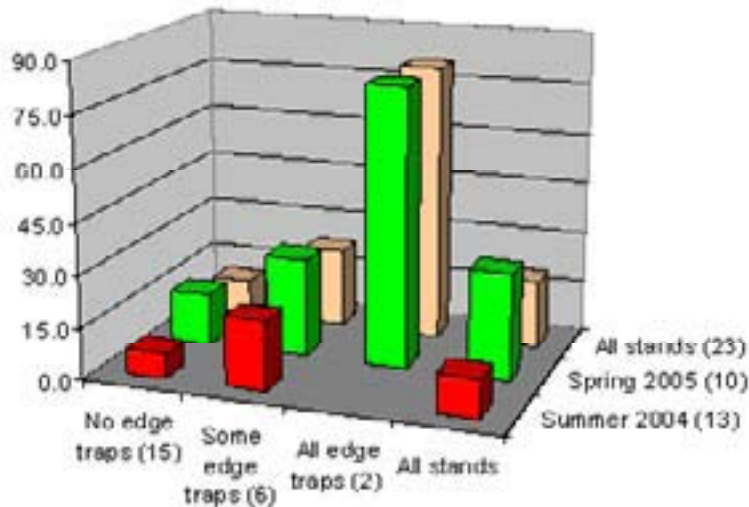


Figure 2. Stands with increasing number of traps placed on the edge of the stand and stands thinned during the spring had significantly higher numbers of turpentine beetles than stands with few or no edge traps and those thinned in the summer of 2004

in one of the spring-thinned stands which had 3 traps with over 100 beetles (113, 239 and 313) each and several traps with over 50 beetles, all traps were placed near a south-facing edge which bordered an open field. These traps may have been more likely to attract beetles entering the stand on strong wind currents. If the mean number of beetles caught is regressed on the months between thinning and beetle flight in May (i.e. June 2004 is 11 months and February is 3 months prior to flight), the F -statistic is 5.07 and p -value is 0.035 which is significant but does not account for much of the variability ($R^2 = 0.194$). If a code for edge placement of traps is added (0-no edge traps, 1- some edge traps, 2-all edge traps), the F -statistic increases to 29.905 with a p -value of <0.000

and a high R^2 (0.749).

In conclusion, time of year of thinning seems to be correlated with the number of red turpentine beetles (*D. valens*) attracted to these stands the following flight season, however trap placement may also play a significant role, especially in stands thinned in the spring before beetle flight. Further investigation should be undertaken to compare similarly placed traps in these 2 groups of thinned stands.

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The second year of a collaborative study between the University of Wisconsin-Madison and the Department of Natural Resources on Red Pine Pocket Mortality included the following: 1) tree assessments for insect damage and tree mortality, 2) establishment of 3 new asymptomatic controls, 3) continuation of trapping on the 31 study plots focusing on three primary insect culprits in red pine demise and their predators, and 4) establishment of traps to study insect biodiversity in and around the pockets. The upcoming year will involve two new studies with two more collaborators.

In the first quarter of 2005, tree evaluations for mortality and insect damage were completed along with the establishment of three new asymptomatic control plots in the Black River State Forest. The evaluations involved checking each tagged tree on all sites in the study (13 root severed sites, 8 symptomatic pockets with no treatment and 10 asymptomatic controls) for *Ips spp* and *Monocamus spp* exit holes, and *Dendroctonus valens* pitch tubes (number of tubes recorded). *Hylobius radialis* sampling was performed using a stratified random sample of 24 trees. Eight trees within three zones, inside of the pocket, root sever edge and outside the sever line, were sampled for damage below the soil on the tree. Root weevil damage typically manifests as a tar-like appearance of pitch in the soil along the base of the tree. All trees were rated as healthy, declining or dead.



Three kinds of traps used in the study were (from left to right) funnel traps (for *Ips spp* and *Monocamus spp*), PVC pitfall traps (for *Hylobius spp*) and milkjug traps (for *Dendroctonus valens*).

Trap deployment to monitor bark beetles, wood borers and lower stem feeding insects were placed near the end of March. Lindgren funnel traps were strung eight feet above the ground and baited with aggregation pheromones; two traps with ipsdienol and lanerione bubble caps and two traps with ipsenol to monitor *Ips spp* and *Monocamus spp*. Twelve milk-jug traps and twelve PVC pitfall traps baited with monoterpenes were positioned two rows outside of root-severed sites (~10m from the pocket in control sites) and four of each trap type were placed at all other controls and used to monitor lower stem or root feeding insects such as *Dendroctonus valens* or *Hylobius spp*, respectively.

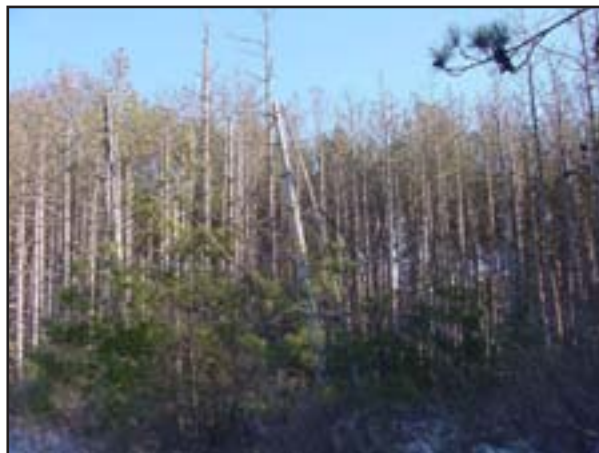
Capture numbers for 2005 are currently being tabulated. In 2004, *I. pini* and *I. grandicollis* trap numbers totaled approximately 54, 000.

The insect biodiversity study was executed simultaneously with the aforementioned monitoring. Two flight-intercept traps (one trap placed in the center of the plot and one trap set ~5 m outside of the pocket) and six unbaited pitfall cups (three cups placed ~5m inside the pocket and three cups ~ 15m outside the pocket spaced equidistant) were positioned in all sites. Identification of captured insects is in progress. The insect biodiversity portion of the study concluded in 2005. The insects are currently being identified.

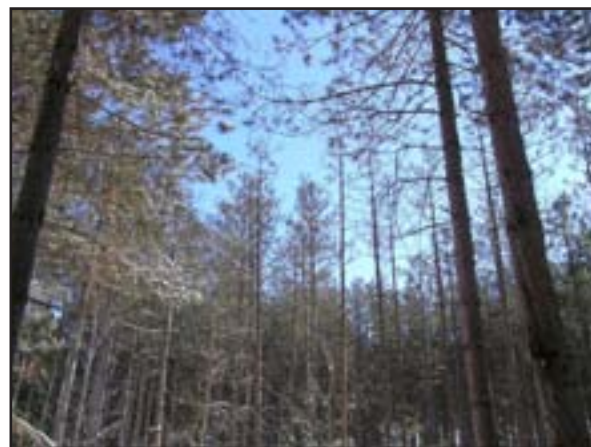
All traps in both studies were sampled approximately every two weeks. The milk jug and PVC pitfall traps were sampled until mid-July and all other traps until mid-September.

Tree evaluations for damage and mortality were again performed this fall. Results for tree mortality over the past two years show that, in the 13 root severed sites (approximately 2800 total trees), 106 trees have died. Only one of the dead trees occurred outside the root graft sever line. This tree was heavily damaged during the severing process. The remainder of the year will focus on finishing the spatial mapping of each red pine in all study sites.

The deployment of funnel, milk-jug and PVC pitfall traps will be replicated next year. Two other studies will be launched in 2006. Beginning in March, an insect predator-prey dispersal study will begin in collaboration with Southern Illinois University. The second study on red pine defense responses will be conducted approximately in mid -June in collaboration with Ohio State University.



Root severing was done at a red pine pocket at Bakkens Pond in Sauk County



A pocket control (red pine pocket with no trenching) from Waushara County.

Gypsy Moth Biocontrol Project

Bria Radtke
Gypsy Moth Suppression Coordinator
West Central Region
Eau Claire WI

A biological control survey was initiated in cooperation with the USDA-ARS Beneficial Insects Introduction Laboratory in Newark, Delaware. Weekly collections of larvae and pupae, and a fall collection of egg masses, were made in 6 counties from Rock County in southern Wisconsin to Marinette County in northern Wisconsin. Seven insect species were found to attack larvae and pupae: *Cotesia melanoscela*, *Compsilura concinnata*, *Pimpla disparis* (see photo), *Parasetigena silvestris*, *Lespesia aletiae*, *Theronia atalantae atalantae*, and *Brachymeria compsilurae*. *Ooencyrtus kuvanae* (see photo) was the only egg parasitoid recovered. *O. kuvanae* is best adapted to southern Wisconsin, but was found as far north as Marinette County. The gypsy moth-killing pathogens *Entomophaga maimaiga* and Nucleopolyhedrosis Virus were found at an outlying infestation in western Oneida County.



Pimpla disparis wasp
reared at Peshtigo

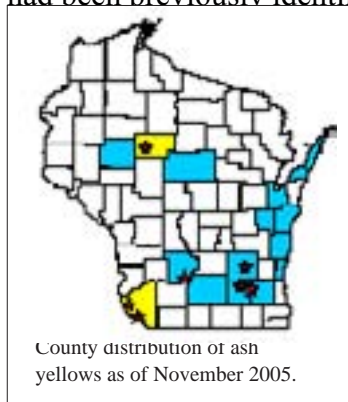


Ooencyrtus kuvanae
parasitoid on egg mass

Ash yellows PCR test results

Kyoko Scanlon
Forest pathologist

In July, 2005, samples were collected from 8 locations where ash dieback had been reported in order to test for ash yellows through genetic analysis. The objectives of the test were; 1) to confirm some of the sites that had been previously identified as ash yellows based on the existence of witches' brooms, 2) to test for the



existence of phytoplasma in trees that were showing dieback without witches' brooms, and 3) to evaluate the frequency of exhibition of general ash yellows symptoms, such as stunted growth, subnormal leaf size, and light green leaf color, on ash yellows positive and negative trees. A 1.5" x 1.5" wood block and leaf samples were collected from each site and sent to Agdia Inc. (30380 County Road 6, Elkhart, Indiana 46514) by overnight delivery on the same day the sample was collected. In their lab, samples were tested for the presence of phytoplasmas using the Phytoplasma Nested PCR (Polymerase Chain Reaction) test with 3 different primer pairs. Final positive confirmations were made by RFLP (Restriction Fragment Length Polymorphism) analysis.

The analysis revealed the existence of the organism for 7 out of 8 locations (Table 1). Many of the sampled trees that were positive for ash yellows were not showing the characteristic symptoms of ash yellows, such as a witches' broom, stunted growth, or light green leaf color. For example, only 1 out of 7 trees tested positive had a witches' broom. Two trees had epicormic branches with abnormal growth, but they didn't possess a characteristic of a witches' broom (listed as Yes?). Both of the samples were positive for phytoplasma. Only 1 out of the 7 positive trees had foliage that was light green in color. None of the positive trees had foliage with sub-normal leaf size, except for leaves on epicormic branches. All of the sampled positive trees exhibited branch dieback (or mortality) and epicormic branches. One sample that was negative for phytoplasma was also showing dieback with epicormic branching. Though it was subtle, foliage of the negative sample was showing slight chlorosis. Positive locations included a campground, yard, woodlot, and forest.

The results indicate that ash yellow positive trees may show only a few or no apparent symptoms of ash yellows at any given time, except for dieback and possibly epicormic branches. This implies that field diagnosis of ash yellows cannot be made by the existence of general declining symptoms, such as stunted growth, light green foliage, subnormal size foliage, top dieback, and epicormic branches. Witches' brooms appear to be a good diagnostic characteristic to positively identify ash yellows in the field when witches' brooms are present. All of the samples either with witches' brooms (site #1) or with suspicious brooms (site #6 and #8) were positive. Although sampled trees from the site #5 and #6 did not have any witches' brooms at the time of sampling, witches' brooms had been observed on other trees on the same stand/property previously. However, witches' brooms are developed only on a small portion of the diseased trees at any given time. Diagnosing ash yellows solely by the existence of witches' brooms may underestimate the prevalence of this disease. The use of the genetic test could provide us with a more accurate distribution of ash yellows in Wisconsin.

Depending on available funding, additional ash trees that are showing dieback without witches' brooms will be tested for the genetic test for ash yellows in 2006. Samples from counties where ash yellows hasn't been confirmed will be the high priority for the test. Possible sample trees will include ash trees identified by 2005 emerald ash borer visual surveys and reports from 2006.

Table 1. Sample locations, symptoms on sample trees, and the PCR test result

	Location description	County	PCR test	Witches' broom	Stunt- ed	Light green foliage
1	Nelson Dewey State Park	Grant	Positive	Yes	Yes	No
2	Wyalusing State Park	Grant	Positive	No	Yes	No
3	Eastern Taylor Co.	Taylor	Positive	No	Yes	No
4	Baraboo	Sauk	Positive	No	No	No